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EDITORIAL

Press and Centrifugal Palm Oil Extraction.

Ever since the erection of the first oil palm factory in Malaya in 1925 there has been considerable diversity of opinion regarding the relative merits of presses and centrifugal extractors for the original treatment of oil palm fruit.

The treatment of any oil bearing material for the recovery of oil by expression is a method which is used universally and has been so from time immemorial, whereas the centrifugal extraction system is a modern development and its application is limited to soft and pulpy material which is easily mashed. The pericarp of the oil palm fruit fulfils these conditions.

In Sumatra the press system has been employed exclusively, while in Malaya out of a total of 16 oil palm factories, 14 have installed centrifugal and 2 press machinery.

In a previous number of this Journal* it was shown that arrangements had been made for the installation of both types of machinery at the Government Experimental Plantation, Serdang.

The results of experiments with the centrifugal system have already been published in the Journal,† the figures showing, in this particular instance, that between 88 and 89 per cent. of the oil content of the fruit could be recovered.

In the article included in the present number, entitled "A Comparison of the Press and Centrifugal Methods for Treatment of Oil Palm Fruit" by Major C. D. V. Georgi, the author describes a similar series of experiments with the press system as a result of which the possibilities of the two methods under the same conditions are compared.

These experiments have proved that while slightly more oil is recovered from the fruit by expression as compared with centrifugal extraction, the losses on purification of the crude oil are greater for the press than for the centrifugal system, since the latter produces what may be described as a clean crude oil.

In this connection it should be noted that many of the results obtained at Serdang confirm previous figures obtained from analyses of average samples from large factories.

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* *Malayan Agricultural Journal,* Vol. XIX, No. 8, August, 1931.

† *Malayan Agricultural Journal,* Vol. XX, No. 9, September, 1932.

The general conclusion is that when commencing the process with clean fruit, as is the practice at Serdang, the final percentage of oil recovery from the fruit is almost identical in both methods.

From the point of view of upkeep, the experimental factory at Serdang has shown that the centrifugal plant has the advantage over the press in that the cost has been lighter in this respect, the centrifugal extractor having required less frequent adjustments.

Concerning the reliability of the centrifugal machinery, it is noteworthy that some plants which were installed in Malaya more than six years ago are still working efficiently.

It has also been proved at Serdang that the centrifugal plant requires 33 per cent. less tank space than the press, owing to the fact that the crude oil does not require to be diluted with water before steaming.

The centrifugal system has the disadvantage that the extractor works intermittently. Since experiments have shown high excess steam pressures in the digestor to be unnecessary it should be possible to modify the design of this vessel so as to permit of a system of continuous digestion, thereby increasing the output of the centrifugal extractor.

This series of investigations emphasises the importance, especially for large factories, of the introduction of a regular system of factory control, similar to that adopted with such success in sugar factories, for the analysing of all waste products, so that losses of oil may be reduced to a minimum and the maximum recovery of the product ensured.

Malayan Rice Production in 1932

His Excellency The Governor, Sir Cecil Clementi, initiated a campaign having for its object the encouragement of rice production. His first pronouncement on this subject is contained in his "Message to the *Malayan Agricultural Journal*" of May 1930, shortly after his arrival in Malaya. In this Message he referred to the dependence of Malaya on imported rice and stated that

> "..... the time has now come when more attention should be paid to rice cultivation as well as to pastoral industries, in order that the staple food of the people may be made available locally."

The policy of His Excellency received the support of Their Highnesses the Rulers, who have continually urged upon their subjects the importance of rice production. The Administrative Service has assisted materially in a similar direction.

The Rice Production Committee examined the subject exhaustively and from every angle, and the favourable result of the past padi season is in great measure due to the prompt translating into action of the findings of this Committee, in particular to the inauguration of the Department of Irrigation and Drainage.

The campaign has been furthered by the insistent efforts of the Department of Agriculture who have carried on continual propaganda through cinema films, lectures and demonstrations during the tours of the lecture caravan, and have inaugurated padi test plots throughout the country.

For many years the policy has been pursued of introducing high-yielding strains of padi, and of minimising the great damage occasioned by rats and other pests by organised work of destruction in all important padi districts.

The success of the padi season 1931 - 32, though in no small measure due to the favourable weather and to the low price of rubber, is also the result of the concerted action of the various Government departments, both administrative and technical, that have been able to give mutual assistance at many points by reason of the fact that they were actuated by the same motives and had the same object in sight.

In consideration of the foregoing it is very gratifying to note that in the season 1931-32, throughout the Peninsula a total of 724, 980 acres were planted with this crop which produced a yield of approximately 291,000 tons of rice, an increase over 1931 of 17,240 acres, or 2.4 per cent. in area and 31,899 tons or 12.6 per cent. in yield.

In respect of both the acreage planted and the crop harvested, the figures for the above season constitute a record for Malaya. The reason for the apparent discrepancy between the percentage increase in area and yield is accounted for by the fact that the area under "dry" padi, which is generally only a temporary form of cultivation, has declined by 15,000 acres in favour of an increase in the more permanent system of cultivation of "wet" rice by 32,000 acres.

For the previous 14 years annual production has averaged 50 per cent. of the annual net imports, while production has amounted to an average of 32 per cent. of local consumption. In 1932 Malayan production amounted to 73 per cent. of the net imports and to 42 per cent. of the consumption, an increase of 23 and 10 per cent. respectively.

Rice imports in Malaya for 1932 were 409,630 tons valued at over 27 million dollars (Straits currency) as compared with 515,724 tons, valued at 35 million dollars for 1931. In this connection it must be borne in mind that the large number of alien labourers repatriated and the considerable reduction of the purchasing power of the community are factors which have had an appreciable effect on the decline of rice imports and consumption.

Original Articles.

A COMPARISON OF THE PRESS AND CENTRIFUGAL METHODS FOR TREATMENT OF OIL PALM FRUIT

BY

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Introductory.

The present article summarises the results of the remainder of the experiments carried out regarding the factory treatment of oil palm fruit at the Government Experimental Plantation, Serdang, to which reference was made originally in a previous number of this Journal.*

The scheme of work outlined in that article included a study of both the centrifugal and press methods for treating the fruit in order to compare their relative efficiencies. As regards the centrifugal method a full description of the various experiments, including a statement as to the efficiency of the process, was published in a recent number of this Journal.†

In the present article, therefore, it is proposed to consider the press method on similar lines to those adopted for the centrifugal system, the individual experiments for each particular stage of the process being first described, followed by the figures for the efficiency tests. As a result certain observations regarding the comparative efficiencies of the two systems will then be offered.

As explained previously, the object of a preliminary study of the separate stages is to ascertain the particular optimum conditions so as to secure the maximum efficiency for the whole process. From the point of view of the complete process it will be realised that there are certain stages common to the two systems; in such cases therefore only brief references will be made, since full details have been given when dealing with the centrifugal process.

Attention is also drawn to the fact that there are two types of press in general use, the Stork press supplied by Messrs. Gebr. Stork & Co., Amsterdam, Holland and the Krupp press manufactured by Messrs. Fr. Krupp & Co., Grüsonwerk, Germany. The present series of experiments was carried out with the Stork press, so that the results of the efficiency tests can be taken as applying only to that type.

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* *Malayan Agricultural Journal*, Vol. XIX, No. 8, August 1931.

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Sterilisation of Fruit.

No change has been made as regards the period of sterilisation, which is maintained at 45 minutes. The acidity of the oil has shown no tendency to increase, even though the present practice is to leave a proportion of trash with the fruit to ensure a better recovery of oil.

It is interesting to note that, taken over a period of 8 months, the monthly variation in the figure for the acidity of the oil has not exceeded 0.7 per cent., the weekly variations being also of a similar order. The following figures give the limits in the case of the monthly samples, the acidities being calculated as palmitic acid per cent.

Maximum per cent.	Minimum per cent.	Average per cent.
4.8	4.1	4.5

Digestion of Fruit.

Unlike the closed digester used in the centrifugal process, the digester in the Stork press unit is of an open type. Further, it operates continuously, being maintained full throughout the whole of the working period, sterilised fruit being added at the top as often as a press charge is withdrawn from below. With an open digester the number of variables is therefore reduced to two (*a*) the period of digestion (*b*) the steam pressure in the jacket of the digester.

As regards the period of digestion, a preliminary series of experiments showed that with the digester full, an excess steam pressure of 45 lbs. per square inch in the jacket and the stirring arms making about 30 revolutions per minute, approximately 20 minutes elapsed before a press charge, showing no trace of undigested fruit, could be withdrawn. During this period a considerable amount of oil exuded from the mash and flowed into the trough behind the press.

As soon as the initial digestion had been completed, however, no trouble with undigested fruit was experienced, even though, as explained previously, the digester was maintained under full load. To ensure such a satisfactory digestion experience shows that three stirring arms should be fitted to the vertical shaft of the digester; with only two arms a distinct tendency for undigested fruit to pass through has been noticed.

It was considered unnecessary, therefore, to carry out a special series of experiments in which the period of digestion was varied, since the process can be followed so easily and only a small proportion (one-fifth) of the full charge is removed at one time for pressing.

With regard to the excess steam pressure in the jacket, it was found important to maintain this pressure at a minimum of 45 lbs. per square inch. For this purpose a special gauge was fitted to the steam supply pipe leading to the jacket, the condensed water being drawn off from time to time as required.

This excess steam pressure is much greater than that found necessary for the closed type of digester in the centrifugal plant. Experience shows, however, that the two systems differ considerably as regards the optimum moisture content for the mash.

With the centrifugal system a high steam pressure is not required, since the object of digestion is merely to rupture the oil cells, maintaining the mash as liquid as possible, thereby also facilitating the subsequent expulsion of oil in the centrifugal extraction. In the press system, especially when wet steam is used as the sterilising agent, it is preferable to reduce the moisture content of the mash during digestion in order to ensure a more satisfactory expression of oil. An open digester with a relatively high steam pressure in the jacket is therefore essential, and the jacket of the Stork digester is constructed to withstand an excess steam pressure of over 100 lbs. per square inch.

A considerable reduction in the moisture content of the pericarp is effected when the fruit bunches are sterilised under pressure and a vacuum applied; in fact it is understood that as a result of such treatment the moisture content of the mash can be reduced to such an extent as to affect adversely the expression of the oil. In order to counteract the possibility of the mash becoming too thick and gummy the provision of a perforated ring coil for the supply of live steam to the contents of the digester is recommended by the makers of the plant.

Expression of Oil.

The press method for treatment of the mash differs from the centrifugal process in the following respects (*a*) the smaller quantity treated per unit charge (*b*) the possibility of varying the period of expression, thereby ensuring a greater control over the the oil content of the pericarp residue.

As regards an individual charge, the quantity of mash amounts to approximately 130 lbs., only about one-fifth of the charge for the centrifugal extractor.

In order to ascertain the variations in the oil contents of the pericarp residue from clean fruit pressed for varying periods, a series of experiments was carried out in which the mash was pressed for 4, 5 and 6 minutes respectively. These periods represented the actual times during which pressure was applied, stop-watch records being taken.

The minimum was fixed at 4 minutes, since with a shorter period of pressing it was found that the pericarp residue was apt to retain a considerable proportion of oil.

Although there is no accumulator so as to ensure a more rapid working of the press, the pumps being worked direct from the engine, the recorder showed almost invariably that the maximum pressure of 350 kilogrammes per square centimetre, (2¼ tons per square inch) was attained between 45 seconds and 1 minute after closing the press. This would correspond to the mash being under maximum pressure for approximately 3, 4 and 5 minutes respectively.

The results of the experiments are shown below, the oil contents being calculated in all cases on a moisture-free basis.

Period of pressing minutes	Oil content of residue moisture-free basis per cent.
4	22.5
5	21.3
6	19.7

The figures show clearly that by extending the period of pressing there is a corresponding decrease in the oil content of the residue, calculated on a moisture-free basis. Further, even when pressing for only 4 minutes, the oil content of the pericarp residue is approximately 1 per cent. less than that found for a similar residue from the centrifugal extractor.

As regards the samples taken for analysis, it may be mentioned that these were drawn from larger ones obtained by mixing the whole of the fibrous residue in one of the press cakes from every alternate press charge, the middle cake in the filling always being taken. Since the quantity of fruit treated per day amounts to approximately 6000 lbs. it can be calculated that the figures are based on the results of analysis of a sample drawn from approximately 20 cakes. It is claimed, therefore, that sampling may be considered reasonably representative.

Although, for example, by pressing the mash from clean fruit for a period of 6 minutes the oil content of the residue, calculated on a moisture-free basis, can be reduced to 19.7 per cent., thereby also expressing the greater part of the gummy matters present and facilitating the subsequent separation of fibrous residue and nuts in the screen, the output from one press would be small. Assuming that the press is worked by one labourer and allowing a total period of $1\frac{3}{4}$ minutes to empty and fill the press, the aproximate outputs per hour with the periods specified above and allowing 130 lbs. per charge would be approximately as follows :—

Period of pressing minutes	Output per hour lbs. of fruit
4	1360
5	1160
6	1010

When carrying out the efficiency tests it was decided, therefore, to press for only 4 minutes, the output of fruit per hour with that period of pressing being approximately the same as the amount of fruit treated in the same period in the centrifugal process. The capacity of the digester, which is the controlling factor in the centrifugal process, is approximately 700 lbs. of fruit and although digestion is maintained for 30 minutes and a period of 5 minutes must be allowed for emptying and filling the digester, it can be calculated that the net output per hour approximates more closely to a period of pressing of 4 minutes than to 5 minutes.

The actual working of the press calls for little comment except that it is considered somewhat exacting, especially for one labourer. Reference will be made to this point later when discussing the question of labour in the factory.

In view of the slightly lower oil content of the fibrous residue from the press compared with that from the centrifugal extractor, a suggestion was made that it might be economical to treat the residue from the centrifugal extractor in the Stork press, thereby recovering a further quantity of oil.

Experiments showed, however, that pressing would have to be confined to the fibrous portion of the residue, since if the residue from the centrifugal extractor was digested the nuts tended to gravitate to the bottom of the vessel leaving the pericarp residue above.

Although when the fibrous residue was pressed a small amount of oil was recovered, the latter was mostly in the form of sludge, which would involve relatively large losses in purification. Further, on account of the voluminous nature of the fibrous residue, the press could only be charged at a slow rate, so that both from this point of view and that of the small recovery of oil, secondary treatment of the fibrous residue from the centrifugal extractor in the Stork press is not an economical proposition.

Washing of Crude Oil.

The satisfactory separation of the oil from the mixture of oil and water obtained in the press process is slightly more complicated than in the centrifugal system.

If the crude oil is treated with live steam direct the relatively large amount of cellular matter present prevents a clean separation of oil and water. It is necessary, therefore, to dilute the crude oil with water before treatment.

Since the addition of water increases the amount of tank space required to treat a given quantity of crude oil, a series of experiments was carried out to ascertain the minimum quantity necessary to enable the oil and water to separate satisfactorily after treating with live steam for 2 hours and then allowing the mixture to stand for 16 hours. Consideration was given both to the amount of sludge and the oil content of the water that is run to waste.

The results showed that an addition of water equivalent to approximately 40 per cent. of the volume of the crude oil was sufficient to effect a satisfactory separation, and further it was advisable to pump the crude oil into boiling water.

The following procedure was therefore adopted. The number of press charges and the approximate volume of crude oil having been ascertained, the requisite amount of water is placed in the wash tank and brought to the boil, the mixture being then maintained at or near the boiling point until the tank

has received its complement of crude oil. The contents of the tank are then boiled for 2 hours and allowed to settle for 16 hours. For example, it was found that the crude oil from 16 pressings with an additional 12 inches of water, approximately 54 gallons, constituted a full charge for a wash tank.

Although the volume of sludge for a given quantity of oil, using the press system, is usually greater than with the centrifugal system, the sludge layer is well defined and further, the oil content of the wash water is only very slightly greater than that found when using the centrifugal process.

It will be realised, however, that as a result of the addition of water, there is a much greater volume of wash water than with the centrifugal process, so that the proportionate loss of oil in this respect is much greater. Experiments showed that, omitting the sludge, the volumes of washed oil and wash water were in the proportion of approximately 1 to 1.6. The question of the requisite tank capacity for the two systems will be referred to later.

Treatment of Sludge.

The further treatment of the sludge from the wash tank calls for no special comment, the sludge being treated according to the method described for the centrifugal process.

Satisfactory results were obtained, although it was noticed that there was a tendency for the oil content of the residual water from pressed oil to be slightly greater than that of oil from the centrifugal system.

Purification of Oil.

No change has been made as regards the method of purification with the De Laval separator. Equally good results are obtained with the oil from the two systems as the figures from the results of analyses of the latest monthly samples show, one system or other being used continuously throughout the period.

System		Moisture per cent.	Dirt per cent.
Press	...	0.20	Trace
Centrifuge	...	0.17	Trace.

Separation of Pericarp and Nuts.

No difficulty was experienced as regards effecting a satisfactory separation of the fibrous residue and nuts in the screen, in fact, compared with the residue from the centrifugal extractor, there is less tendency, especially with clean fruit, for the spaces between the bars to become choked with fibrous residue, thereby necessitating less frequent cleaning. This is doubtless due partly to the lower

moisture content of the residue (45 to 50 per cent. compared with 50 to 55 per cent. for the residue from the centrifugal extractor) and partly to the larger amount of gummy matter expressed with the oil, leaving therefore a more friable residue for treatment in the screen.

Manufacture of Kernels.

No change has been made in the methods previously described for the drying and cracking of the nuts and the subsequent separation of the kernels from the shell fragments.

As regards the drying of the nuts by storage, experiments have shown that if the pile is only approximately 3 feet high, insufficient heat is developed during 12 days within the pile to reduce the moisture content of the kernels sufficiently to ensure satisfactory cracking. In the case of small quantities of nuts, therefore, the pile was opened after this period and the nuts spread out on the floor of the factory to dry for a further week before cracking. In this way, the proportion of kernels broken on account of insufficient drying was reduced to a minimum. Further, with the nuts stored in a thin layer there was no danger of discoloration of kernel on account of possible local overheating.

The above contingency is, however, unlikely to arise in the case of normal estate factory practice on account of the much larger output of nuts.

The quality of the kernels is satisfactory. The sample taken for analysis from the first consignment shipped showed a small excess of oil, calculated on a 4 per cent. moisture basis, over the standard, 49 per cent., and this slight excess was confirmed as a result of the Liverpool analysis, which showed an oil content of 49.2 per cent., calculated on the sample as received.

The figure of 4 per cent. quoted is an arbitrary choice and has been adopted merely as a basis for judging the oil content on the average moisture content figure quoted in standard literature for palm kernels on arrival in England.

As regards colour, the proportion of off-colour kernels remains approximately the same, *i.e.* 15 to 20 per cent. and in most of those adjudged off-colour it is a case of a tinge rather than an actual discoloration throughout the kernel.

Summary of Process.

Having thus recorded the results of the individual experiments for the various stages it is proposed to summarise the conditions for the whole process. Since, however, the present paper attempts a comparison of the two methods for the treatment of oil palm fruit it seems advisable to include in the summary the details for the various stages of the centrifugal process. Table I includes, therefore, the details for both systems.

Table I.

Comparison of Press and Centrifugal Systems.

Stage of Process	Press System	Centrifugal System
Fruit	Loose fruit, well mixed, still containing a small proportion of bunch trash.	
Sterilisation	45 minutes with live steam. The hot fruit should be transferred as quickly as possible to the digester.	
Digestion	20 minutes before withdrawing first press charge, afterwards continuous. Steam pressure in jacket at least 45 lbs. per sq. inch.	30 minutes, 5 lbs. steam pressure in body, 15/20 lbs. steam pressure in jacket for first two charges, 5/10 lbs. for remainder of working day.
Pressing	Mash pressed for 4 minutes, pump pressure approximately 2¼ tons per sq. inch. Continuous working.	
Centrifugal Extraction		15 minutes, steam injected from 3 minutes after starting to 3 minutes before stopping.
Washing of Crude Oil	Dilution of crude oil with 40 per cent. of its volume of water. 2 hours boiling with live steam, settling for 16 hours. Final proportions of oil and water are approximately 1 of oil to 1.6 of water.	2 hours boiling with steam, settling for 16 hours. Final proportions of oil and water are approximately 2 of oil to 1 of water.
Treatment of Sludge	The sludge is diluted with approximately its own volume of water, the liquid is boiled with live steam for 2 hours after which it is settled for 16 hours.	
Purification of Oil	The washed oil and the oil recovered from the treatment of the sludge are passed through a fine metal gauze filter, heated and run direct to the De Laval separator.	
Treatment of Residue	The pericarp residue is separated from the nuts in a revolving screen. The pericarp residue is used as fuel.	
Treatment of Nuts	The nuts are dried by storage in bins for 12 to 14 days and cracked. The kernels are separated from the shell fragments by treatment of the mixture in a suspension of clay in water. The kernels are washed and dried and bagged; the fragments of shell are washed to free them from adhering clay, dried and used as fuel.	

Efficiency of Process.

In order to make a comparison with the centrifugal system, a series of four efficiency determinations was also carried out with the press system, similar methods for weighing or measuring, sampling and analysis of the waste products being followed in both instances.

Further, the weights of fruit treated in all tests were of same order.

Although an example of the method of calculation has already been worked out when discussing the efficiency of the centrifugal process, an example from one of the press tests is given below in order that losses of oil at various stages may be compared.

		lbs.
FRUIT		
Weight of fruit treated	...	8421
PALM OIL		
Weight of oil recovered	...	2220
LOSSES OF OIL		
(*a*) *Pericarp residue*		
(lbs. of oil per lb. of pericarp residue)		
(i) 1485.5 x .1099	...	163.26
(ii) 817.5 x .1052	...	86.00
(*b*) *Nuts*		
(lbs. of oil per lb. of nuts)		
(i) 1524 x .0014	...	21.34
(ii) 1217 x .0008	...	9.61
(*c*) *Washing of crude oil*		
(lbs. of oil per gallon of water)		
(i) 122 x .077	...	9.39
(ii) 106.5 x .053	...	5.64
(iii) 99.5 x .072	...	7.16
(iv) 95 x .116	...	11.02
(*d*) *Purification of sludge*		
(lbs. of oil per gallon of water)		
(i) 48 x .070	...	3.36
(ii) 78 x .115	...	8.97
Total	...	325.75

EFFICIENCY OF PROCESS

$$= \frac{2220 \times 100}{2220 + 325.75} = \frac{222000}{2546} = 87.2 \text{ per cent.}$$

OIL CONTENT OF FRUIT

$$= \frac{2545.75 \times 100}{8421} = 30.2$$

The results show that, commencing with fruit containing a small proportion of trash, approximately 87 per cent. of the total oil present in the fruit has been recovered.

The inclusion of the small proportion of non-oil-bearing trash is reflected in a slightly low figure for the oil content of the fruit.

Although only one example has been quoted, the other three tests, to which reference has already been made, gave results of the same order as are shown by the following figures, which include those for the example worked out :

Amount of fruit lbs.	Efficiency per cent.	Oil content of fruit per cent.	Remarks
6208	85.8	28.4	Fruit with trash
8421	87.2	30.2	Do.
9748	87.5	29.4	Do.
7390	88.2	29.0	Do.

It appears reasonable to assume, therefore, that the efficiency of the press process as described above is approximately 87.2 per cent.

The figure for the oil content of the fruit is of little significance, since the proportion of trash was not known and the weight of clean fruit could not be calculated. The figures merely serve to show that the proportion of trash varied within narrow limits.

As regards the distribution of the losses of oil, figures show that taking the total loss as 100, the percentage distributions are approximately as follows :—

		per cent.
Pericarp residue	...	78.3
Nuts	...	6.8
Purification of oil	...	14.9

Assuming that the average oil content of the clean fruit is 31.5 per cent., the figure found when determining the efficiency of the centrifugal process, it can be calculated that the final distribution of the oil is approximately as follows :—

		per cent.
Oil recovered	...	27.5
Oil lost in pericarp residue	...	3.1
Oil lost on surface of nuts	...	0.3
Oil lost in purification	...	0.6
		31.5

Comparison of Efficiencies of Press and Centrifugal Extractor.

The results of the two sets of efficiency tests serve to show that, as regards recovery of oil, there is little to choose between the two methods. Although the average figure shows a slight superiority in favour of the centrifugal system,

the difference is too small to recommend definitely from this point of view the adoption of the centrifugal in preference to the press system.

From the point of view, therefore, of oil recovery, the writer prefers to regard the two systems as of equal efficiency and to leave the choice of the system to the individual estate, since apart from the question of recovery of oil, other considerations arise which would influence the choice of system. In this connection, it is proposed, therefore, to offer certain observations on the working of the two systems, which the writer wishes to point out are not to be taken as favouring either system. The observations are offered as a result of the numerous trials with both systems carried out at the Government Experimental Plantation, Serdang.

Although as far as the recovery of oil is concerned, the two systems are approximately equal in efficiency, it is interesting to make a comparison of the constituent losses of oil in the two processes. For example, assuming that the average oil content of the fruit is 31.5 per cent. and 88 per cent. of the oil, equivalent to 27.72 per cent. calculated on the fruit, has been recovered, the results of the tests show that the remainder of 3.78 per cent. would be accountable as follows :—

Loss of Oil		Centrifugal system	Press system
Pericarp residue	...	3.30	2.96
Surface of nuts	...	0.23	0.26
Purification of oil	...	0.25	0.56
		3.78	3.78

The figures show clearly that although with the centrifugal system the loss of oil in the pericarp residue is 0.34 per cent. greater than in the press system, this increase is compensated by a corresponding reduced loss in purification.

Similarly, regarded from the point of view of the press system, the figures show that although the loss of oil in the pericarp residue is less than in the centrifugal system, there are increased losses of oil in purification.

Incidentally, the results also show that too much importance should not be attached to the figure for the oil content of the pericarp residue from the point of view of calculating oil recovery, the figure merely serving as a guide to the general efficiency of the process.

To sum up, therefore, the results show that while the recoveries of oil by the two systems are approximately the same, the crude oil recovered by the centrifugal process requires less purification than that obtained by the press system, in other words, the centrifugal system extracts what may be described as a cleaner, crude oil.

As regards the extent to which the results given above can be taken as likely to be reproduced in large factories it is claimed that, while the figures can only be regarded as applying to the fruit as treated in the Serdang factory,

their relatively close agreement can be taken as an indication that results of a similar order would be obtained if larger quantities were treated and chemical control, such as described in this article, were a regular feature of Malayan oil palm factory practice.

For example, it is not considered that pressure sterilisation of bunches would be likely to result in an increased recovery of oil from pressed fruit compared with centrifuged fruit. It is probable that with the coagulation of the greater part of the mucilaginous matter in the pericarp during sterilisation there would be in both cases slightly increased recoveries as compared with the present figures.

Further, it may be pointed out that many of the figures obtained in the experiments at Serdang confirm previous figures obtained as a result of analysing average samples of the same waste products from large factories.

Consideration of Certain Factors affecting Centrifugal and Press Systems.

Among the factors determining the choice of either centrifugal extractor or press for the treatment of oil palm fruit may be mentioned the following: (*a*) capital cost (*b*) upkeep (*c*) labour (*d*) steam consumption (*e*) relationship of system to other parts of the plant.

As indicated previously, it is proposed to offer certain remarks regarding these particular factors, the observations being based on the experience gained at Serdang.

(*a*) *Capital cost.* The present capital cost of a Manlove Alliott digester (5 cwt.) and centrifugal extractor (5 cwt.), together with necessary structural ironwork, is approximately $5,850 (Straits currency) c.i.f. Port Swettenham. This plant would be of the same capacity as that installed at Serdang and would have an output of approximately 10 cwt. of fruit per hour.

Although this figure may appear somewhat excessive for a plant having such a relatively low output, a plant of double the capacity would only cost approximately $8,800, in other words for a 50 per cent. increase in price the capacity of the plant would be doubled. The larger plant would comprise a digester (10 cwt.) and 2 centrifugal extractors (5 cwt.).

Owing to the difference in the currency basis of Great Britain and Holland, the latter country being still on the gold standard, the cost of the Stork press has appreciated when calculated on a sterling basis, although the makers of the press have reduced prices in order to meet the changed situation.

Before the change in currency basis, the price of a Stork press, having a capacity of 500 kg. per hour, together with the special type plunger pump capable of supplying two presses of the above capacity, was approximately $4,900 c.i.f. Port Swettenham. The addition of an extra press unit, thereby doubling the capacity of the plant, raised the price to approximately $8,100.

Compared with the centrifugal system, the price was, therefore, in favour of the press as the figures in the following table show. Further, an additional advantage was the slightly increased output of the press, when worked for a 4 minute period, referred to previously.

		Price
		$
Single unit press	...	4,900
Do. centrifuge	...	5,850
Double unit press	...	8,100
Do. centrifuge	...	8,800

As a result of the change in currency basis the price is now slightly in favour of the centrifugal plant, the reduced price of the single press unit being approximately $6,070. It should be mentioned that in spite of a reduced price the press unit now offered includes a larger stirring kettle than that fitted at Serdang in order to ensure better digestion and consequently more satisfactory oil expression.

While there is relatively only a small price difference betweeen the single units an increase in size of plant favours the centrifugal system, since as far as can be ascertained the price of a double press unit would be approximately $10,000 compared with $8,800 for the centrifugal plant.

(*b*) *Upkeep.* As regards upkeep, the general opinion was that the slow-moving press was likely to be more reliable than the fast revolving centrifugal extractor. Experience at Serdang does not, however, support this contention, the centrifugal extractor having proved more satisfactory to-date than the press in this respect.

Apart from the renewal of one belt after more than two years' wear, the centrifugal extractor has required no special attention; with the press, however, the upkeep has been heavier, since in addition to the replacement of leather washers, constant adjustment of the pump is necessary in order to secure the maximum working pressure being reached as rapidly as possible.

There is no doubt that the frequent adjustment is probably due to the fitter of average ability being unaccustomed to the working of such a relatively intricate machine as a high pressure pump and with more experience better results will be obtained.

The writer has had no experience of the reliability of the press working under estate conditions although, judging from the fact that this system is employed exclusively in Sumatra, it would appear that presses must have given satisfaction.

Although, the factory at Serdang has not been working sufficiently long to enable the writer to offer a considered opinion regarding the reliability of centrifugal extractors, information from estates shows that these machines have given every satisfaction, some of the original "peg-top" extractors, installed more than 6 years ago, being still in use.

(*c*) *Labour.* As far as can be judged the labour requirements are the same for both systems. For example, at Serdang one labourer works the centrifugal extractor or the press, while with two extractors, each holding 5 cwt., supplied from a 10 cwt. digester, two labourers would be required. This would correspond to one labourer for each press unit.

As stated previously, the actual work with the press is considered more exacting for the labourer, since the work is practically continuous, although on the other hand, the emptying of a centrifugal extractor basket, even with a bottom discharge, is actually heavier work than the charging or discharging of the press.

There is little doubt that from the point of view of output, the weak point of the centrifugal extraction process is its intermittent working and it is hoped that as a result of the determination of the optimum conditions for digestion the makers will endeavour to improve the design of that vessel in order to make the process continuous. This point will be referred to later.

(*d*) *Steam consumption.* Records have been taken of the consumption of water in the boiler when using both systems. The results have shown that in spite of the admission of live steam to the centrifugal basket during the greater part of the period of treatment, the total consumption of water per ton of fruit treated is slightly less for the centrifugal than the press process, the approximate figures being 2,500 lbs. of water per ton of fruit by the centrifugal process compared with 2,700 lbs. of water when using the the press system.

(*e*) *Relationship to remainder of factory plant.* As far as a relationship to the rest of the factory plant is concerned, the important parts are the screen for separating the nuts and fibrous residue, and the oil purification plant.

As stated previously, there is less tendency for the spaces between the rods to become choked by the fibrous residue from the press compared with that from the centrifugal extractor. Since, however, the tendency was not particularly marked, even with the latter, the point is of little importance.

As regards the nuts, it is of interest to note that the surface loss of oil is slightly less in the case of nuts from the centrifugal extractor than from the press. This is probably due to the extra steaming which the nuts receive in the course of centrifugal extraction.

As far as the Serdang factory is concerned, the most important difference lies in the oil purification. Reference to the two examples quoted for efficiency shows that while the amount of oil recovered in each test was approximately the same, 2,220 lbs., (about 250 gallons) the volumes of wash water run to waste were 179 gallons for the centrifugal system and 423 gallons for the press system. Allowing, therefore, for the 250 gallons of oil, it will be seen that while the total tank space required for the centrifugal system was approximately the equivalent of 430 gallons the same amount of oil recovered by the press system required the equivalent of approximately 670 gallons, or rather more than a 50 per cent. increase.

Assuming that the method of purification by live steam is used, it can be calculated, therefore, that the centrifugal system requires approximately 33 per cent. less tank space than that which must be provided for the efficient purification of the oil from the press system.

General Observations on Methods of Treatment of Oil Palm Fruit.

When discussing systems for the treatment of oil palm fruit, it must be remembered that with the fall in the price of palm oil during the last two years, the outlook as regards the factory treatment has changed.

Formerly, when palm oil was selling from £35 to £40 per ton, it was economical for large estates to recover as much oil as possible from the fruit; the pericarp residue from the first pressing was, therefore, either treated in a heavier press to recover a further quantity of oil, or was extracted by means of a solvent, thereby recovering practically the whole of the oil. Under such conditions a slight variation in the oil content of the pericarp residue in the original treatment was of little significance owing to the secondary treatment with its additional recovery of oil.

Now that the price of palm oil has dropped to approximately £18 per ton, the secondary treatment of the residue is not economical and the present aim in factory practice is, therefore, to express as much oil as possible in the original treatment, having regard also to speed and simplicity of working. Further, it seems probable that such conditions are likely to hold for some considerable period.

The question therefore arises as to possible improvements in the present methods. As regards the press system it is understood that more powerful presses having a larger unit capacity are being constructed with the object of reducing the oil content of the pericarp residue as much as possible without cracking the nuts.

In the case of the centrifugal system it is probable that the economic size of the basket has been reached. Improvements, however, are possible as regards speeding up the process by modifying the digester design and introducing continuous digestion, bearing in mind that the experiments as Serdang have shown a high excess steam pressure in the jacket to be unnecessary. Further, the possibilities of a continuous centrifugal extraction system should not be overlooked. It is hoped that the manufacturers of the centrifugal plant will, if possible, initiate work in these directions, so that a continuous digestion and extraction process for the centrifugal system may be ultimately realised.

Conclusions.

The results of the investigation indicate that under the present factory conditions at the Government Experimental Plantation, Serdang, the efficiencies of the centrifugal and press systems are of the same order, approximately 88 per cent. of the oil present in the pericarp being recovered.

The figures for analysis show that while the centrifugal system yields a pericarp residue with a slightly higher oil content than that from the press the losses in purification of the crude oil from the centrifugal extractor are correspondingly lower.

Various observations are offered on the working of the two systems at Serdang and the possibilities of effecting improvements are discussed.

Acknowledgment.

The writer wishes to express his appreciation of the assistance which Mr. V. Ramasamy, Factory Assistant has rendered in carrying out the various experiments and the efficiency tests with both systems.

CORRIGENDUM.

Hybridization of Selected Strains of Padi.

Paragraph 6 of the above article on page 532 of the *Malayan Agricultural Journal* of November 1931 should read as follows:—

The ovary of the flower of Radin No. 2 padi is 1 m.m. in length. There does not appear to be any change in size until 21 hours after pollination, when the commencement to enlarge is just perceptible. Twenty four hours after pollination the length of the developing rice grain is 1.25 m.m.
After 2 days the length of the developing rice grain is 2.50 m.m.
After 3 days the length of the developing rice grain is 4 to 4.50 m.m.
After 4 days the length of the developing rice grain is 6 to 6.50 m.m.
After 5 days the length of the developing rice grain is 7.00 m.m.

After 6 days the husk is fully filled, but the rice is still in the "milk" stage and takes about another 24 days to reach full ripeness.

MALAYAN RICE PRODUCTION 1932.

Prepared by the Economics Branch of the Department of Agriculture, S.S. and F.M.S.

Prices.—The average wholesale prices of rice per picul in Singapore in 1932 were as follows:—Siam rice No. 2 $3.97, Rangoon rice No. 1 $3.73, Saigon rice No. 1 $3.95, while the retail prices of rice in the three principal ports of Malaya of No. 2 Siam rice were, in cents per gantang*—Singapore 30, Penang 34, Malacca 28, as compared with 32, 35 and 31 cents per gantang in 1931.

The price of local padi has varied according to district from 4 cents to 20 cents per gantang. The average price at mill in Krian was 7.5 cents per gantang, as compared with 7.7 cents per gantang in the previous year.

Imports.—As was to be expected in a year when the purchasing power of the labouring classes was much reduced, and on account of the fact that a large number of labourers had returned to India and China, the net imports of rice into Malaya in 1932 shewed a considerable decline over those of the previous year. The following figures set forth the position for the past four years.

TABLE I.

Rice: Malayan Imports and Exports.

Year	Imports		Exports		Net Imports	
	Tons	Value $	Tons	Value $	Tons	Value $
1929	785,558	95,461,036	233,897	28,031,407	551,661	67,429,629
1930	800,443	87,666,723	208,688	23,361,561	591,755	64,305,162
1931	691,112	48,458,102	175,385	13,453,189	515,724	35,004,913
1932	592,145	39,729,242	182,515	12,605,402	409,631	27,123,840

In the year under review, of the gross imports of rice into Malaya approximately, 357,000 tons were from Siam, 220,000 tons from Burma, 9,000 tons from French Indo-China and 5,000 tons from British India.

From the above figures it will be seen that the net imports of rice into Malaya in 1932 were 21 per cent. less than in 1931 and 31 per cent. less than in 1930.

The average declared trade value of imports of rice of all kinds into Malaya in 1932 was $66.21 per ton as compared with $67.87 and $108.67 per ton in 1931 and 1930 respectively.

* Imperial gallon.

Malayan Production.—The total area planted with padi in Malaya in the season 1931—32 was 724,980 acres producing a yield of 197,103,000 gantangs of padi equivalent to approximately 291,000 tons of rice. In the previous season the figures were 707,740 acres, producing 175,967,000 gantangs of padi (259,000 tons of rice) : an increase over 1931 of 2.4 per cent. in area, and 12.6 per cent. in yield.

TABLE II.

Area of Rice Land Planted in Malaya and Yield of Rice.

SEASON	F.M.S.		S.S.		U.M.S.		TOTAL.	
	Area Acres.	Production Rice Tons.	Area Acres.	Production Rice Tons.	Area Acres.	Production Rice Tons.	Area Acres.	Production Rice Tons.
1929—30	174,466	48,727	67,005	25,659	415,727	77,487	657,198	151,873
1930—31	178,930	55,371	67,350	38,837	461,460	164,858	707,740	259,066
1931—32	194,580	66,517	67,980	38,959	462,420	185,489	724,980	290,965

(Yield estimated on a basis of 686 gantangs padi — 1 ton rice).

In respect of both acreage planted and crop harvested, the figures for the season just concluded constitute a record. The nearest approach to this yield was in the year 1921, when it was estimated that the crop amounted to about 255,000 tons of rice.

It will be noticed that in both these record years Malayan agriculture was in desperate straits : in the former year the low price of rubber coincided with a serious rice shortage; in the past season, the uneconomic price of rubber led the Malay population to return to rice production.

The past season has been assisted by favourable weather for padi cultivation in most areas, which is responsible in a large measure to the increase in average yield per acre of "wet" padi from 277 gantangs per acre in 1931 to 297 gantangs per acre in 1932, and "dry" padi from 87 gantangs per acre in 1931 to 139 gantangs per acre in 1932.

The Federated Malay States area planted increased by 15,650 acres to a total of 194,580 acres, and produced a crop of 45 million gantangs of padi, over 7 million greater than in the previous year. The yield of "wet" padi per acre in this area was 245 gantangs as compared with 237 gantangs in 1930-31 season and "dry" padi, 122 gantangs per acre against 144 gantangs in the previous season.

The area planted and crop obtained in the Straits Settlements was almost identical with that of the previous year.

The Unfederated Malay States showed a satisfactory increase in crop of nearly 14 million gantangs of padi (20,000 tons of rice). The area of land under "wet" rice was 393,470 acres, being 20,600 acres greater than that of the previous year while the dry form of cultivation declined by nearly 19,000 acres. The yield per acre of "wet" padi in the last season was 294 gantangs per acre and of "dry" padi 144 gantangs per acre as compared with 281 gantangs and 77 gantangs respectively in the season 1930-31.

Perhaps the most satisfactory feature of the season is the fact that the area under "dry" padi has declined by 15,000 acres in favour of an increase of 32,000 acres of "wet" padi, a conversion of a temporary cultivation to a system having some permanence.

For the past 14 years, annual production to annual net imports has averaged 50 per cent., while production has amounted to an average of 32 per cent. of local consumption. These figures are also approximately those relating to the year 1931. In 1932 Malayan production has amounted to 73 per cent., of net imports and to 42 per cent. of consumption. The figures for the past five years are as follows :—

TABLE III.

Malayan Percentage Production of Rice to Net Imports and Consumption.

SEASON	Percentage Production to Net Imports	Percentage Production to Consumption
1928	37	27
1929	34	25
1930	26	21
1931	50	33
1932	73	42

Table IV.

Area of Land planted in Malaya and Yields Padi 1931-32.

	Wet		Dry		Total	
	Acres	Gantangs	Acres	Gantangs	Acres	Gantangs
F.M.S.						
Perak ...	88,160	24,341,000	14,510	1,725,000	102,670	26,066,000
Selangor ...	20,840	3,264,000	3,260	264,000	24,100	3,528,000
N. Sembilan ...	32,860	9,574,000	370	51,000	33,230	9,625,000
Pahang ...	32,780	5,658,000	1,800	183,000	34,580	5,841,000
Total ...	174,640	42,837,000	19,940	2,223,000	194,580	45,060,000
S.S.						
P. Wellesley ...	32,080	12,175,000	730	232,000	32,810	12,407,000
Penang ...	4,340	2,048,000	—	—	4,340	2,048,000
Dindings ...	130	—	230	57,000	360	57,000
Malacca ...	30,470	11,879,000	—	—	30,470	11,879,000
Total ...	67,020	26,102,000	960	289,000	67,980	26,301,000
U.M.S.						
Johore ...	10,890	1,211,000	8,410	726,000	19,300	1,937,000
Kedah ...	203,270	71,068,000	7,500	1,150,000	210,770	72,218,000
Perlis ...	40,470	11,883,000	—	—	40,470	11,883,000
Kelantan ...	102,840	25,567,000	38,540	5,491,000	141,380	31,058,000
Trengganu ...	36,000	5,963,000	14,500	2,593,000	50,500	8,556,000
Total ...	393,470	115,692,000	68,950	9,960,000	462,420	125,652,000
Total Malaya ...	635,130	184,631,000	89,850	12,472,000	724,980	197,103,000

NOTES:— 1. Areas to nearest 10 acres.
2. Yields to nearest 1,000 gantangs.

Reviews.

Plantation Crops.

Empire Marketing Board 63 pp. H.M. Stationery Office, Kingsway, London, W.C. 2, November 1932. Price 6d. net.

The Statistics and Intelligence Branch of the Empire Marketing Board has compiled a summary of figures of production and trade relating to sugar, tea, coffee, cocoa, rubber, tobacco and spices under the above title.

The Foreword points out that "The course of international trade, always shifting, is to-day undergoing abnormally rapid changes, and the extension of the policy of Imperial Preference in the United Kingdom makes it of special importance that the main statistical facts as to the Empire's trade should be set out clearly and succinctly".

Statistical data of this description is of inestimable value to research workers scattered throughout the world, and it will be of advantage if the Empire Marketing Board would, at regular intervals, publish new editions or appendices which will keep the subject matter up to date.

D. H. G.

Bibliography of Tropical Agriculture 1931.

Published by the International Institute of Agriculture, Rome, Treves, Treccani, Tumminelli, S.S. 32 via Michelangelo Caetani, Rome, Italy 70 pp. 1932. Price 10 Liras.

Until the end of 1930, the Bibliography of Tropical Agriculture appeared under the heading of "documentation" in the *Monthly Bulletin of Technical Information of the International Review of Agriculture.* This feature was discontinued for financial reasons. A generous donation has enabled the Institute to publish the present volume which carries the biographical information to the end of 1931.

Under twelve suitable sections, such as Starch and Sugar Plants, Oil Yielding Plants, Fruits, a notice is given with a succinct statement of contents, of every article published during 1931 that deals with tropical agriculture.

Dr. C. J. J. van Hall, who has contributed this information, has performed a valuable service to tropical agriculture. The Institute states that continued publication is possible only if the Institute can be assured that the sale will be sufficient to cover the cost. The publication deserves the support of agricultural institutions of all kinds and it is to be hoped that the continuity of this work may not be interrupted for the financial reasons which at present threaten it.

D. H. G.

Abstracts.

WORLD INDUSTRY IN COCONUT PALM PRODUCTS.

Abstract of "Survey of Oil Seeds & Vegetable Oils" Vol. II "Coconut Palm Products."

A summary of Production and trade in the Empire and Foreign Countries. Prepared by the Statistics and Intelligence Branch of the Empire Marketing Board. December, 1932. Printed and Published by His Majesty's Stationery Office, London. 196 pages, with 8 illustrations and diagrams, price 2s. 0d. net.

The estimated world's acreage under coconuts in 1930 was about 7¼ million acres as compared with 5½ million acres in 1921, an increase of about 30 per cent. during the 10 year period. In both years the British Empire countries accounted for slightly more than half of the world acreage.

World Production and Exports of Copra.

An estimate of the world production of copra based on the figures of acreage and the assumption that 2½ acres of palms yield 1 ton of copra, shows that about 3 million tons of copra are now produced annually. It is estimated that over 40 per cent. of the total production is consumed in the countries of origin.

World exports of copra declined from 1.17 million tons in 1928 to 1.04 million tons in 1930 and, it is stated in this survey, the exports of 1931 were expected to show a further slight decrease. This slight decline is in part due to the increased production of coconut oil in the copra producing areas and to the diminution of prices in the world markets.

Netherlands India and the Philippine Islands supplied nearly 65 per cent. of the whole before the war, whereas they now supply little more than 50 per cent. whilst British Empire countries have increased their combined shares from 20 per cent. to 40 per cent. of the whole. Malaya, in 1930, produced 10 per cent. of the world supplies.

World Exports of Copra and Coconut Oil.

Owing to the rapidly increasing export trade in coconut oil from copra producing countries in recent years, the figures for this commodity should be considered together with those of copra in order to obtain a comprehensive view of the situation. This increasing export of coconut oil indicates that the crushing industries in the copra producing countries are sucessfully competing with those in the centres of consumption and this tendency may be expected to increase, since labour is generally cheaper in the countries of origin. Furthermore the oil produced from fresh copra has a lower free fatty acid content than

that produced from stale copra which has been stored for lengthy periods. Exports of coconut oil from copra producing areas now exceed 200,000 tons per annum of which the British Empire countries furnish over 20 per cent. The Philippines and Ceylon are by far the chief copra producing countries exporting coconut oil, the former exporting about 60 per cent. of its total copra production as coconut oil.

The total net world exports of both copra and coconut oil in terms of copra* reached a peak of over 1½ million tons in 1929, declining to 1⅓ million tons in 1930, of which, in 1930, 23.2 per cent. was in the form of coconut oil.

The percentage share of coconut oil in the aggregate exports was 19.8 in 1926, 23.6 in 1927, 22.3 in 1928, 26.4 in 1929 and 23.2 in 1930.

Comparative Exports of Different Countries.

Although Netherlands India is by far the largest exporter of copra, when exports of copra and coconut oil are combined the greatest share of the world supply of both commodities entering international trade is that of the Philippines which was 29.3 per cent. in 1930 as compared with 28.6 per cent. from Netherlands India in the same year. The next most important shares are those of the British South Sea Islands, Ceylon and Malaya which supplied 11.6, 11.1 and 8.7 per cent. respectively.

It is interesting to note that the next most important share of supply of the two commodities is that of the foreign territories of the South Sea Islands which, in 1930, amounted to 3.2 per cent. of the whole.

Principal Copra Importing Countries.

Before the war, Germany was the principal importer of copra with France a close second. After the war, Germany recovered her premier position for a short period but lost it to the United States of America in 1926.

In 1931 net imports of copra in thousand tons, into the principal importing countries were :—United States 192, France 192, Germany 143, Netherlands 85, United Kingdom 80, and Denmark 70 thousand tons.

Consumption of Coconut Oil in the Principal Consuming Countries.

The demand for coconut oil is largely dependent upon the margarine and soap industries and the available figures of margarine production indicate a marked reduction in the past two years. Soap production has been much more stable than that of margarine in recent years and the popularity of hard soaps has resulted in an increasing proportion of coconut and palm kernel oil in the raw material utilised. The utilisation of these two oils in the soap industry is likely to increase if this tendency continues and the choice between the one or the other will be largely decided by their relative price movements.

*65 tons of coconut oil = 100 tons of copra.

The consumption of coconut oil in the principal consuming countries outside the copra producing areas reached a peak of 870 thousand tons in 1929. In 1930 there was a decrease of about 14 per cent. in the consumption and a further decline of about 5 per cent. in 1931.

Other Coconut Products.

Fresh Coconuts. The trade is comparatively small and localised. About 110 million nuts were exported in 1930 for consumption as nuts and for shredding. Jamaica, Ceylon and Malaya are the principal exporters and the United States is the principal importer.

Shredded and Desiccated Coconut. Ceylon and the Philippine Islands are the main sources of supply, about 50 thousand tons being exported from these countries annually.

Coir. Ceylon and India are the chief exporters of this commodity. Exports from the latter country are almost entirely in the form of manufactured products.

Coconut Cake and Meal. The main sources of world supply are Ceylon, India, Netherlands India and the Philippines. The amount exported now exceeds 150 thousand tons.

Demand for Coconut Products in the United States of America.

Coconut oil is by far the most important ultimate product of the coconut palm and the future prospects of the industry depend almost entirely upon the demand for this oil. The war and post-war periods have witnessed a heavy increase in demand which has been largely the result of developments in the United States of America. Since the war that country has been the largest single consumer of this commodity, about one-third of the world's supplies now finding their outlet there. American demand is largely satisfied by Philippine production, and Philippine production is largely absorbed by American demand. Since 1925, Philippine produce has constituted about 80 per cent. of the estimated volume of coconut oil consumed in America, and America has taken between 80 and 90 per cent. of the Philippine exports of copra and coconut oil. It is thus clear that the United States of America and the Philippines, as far as coconut palm products are concerned, constitute almost a self-contained group and that the coconut palm industry outside the Philippines is likely to remain very largely dependent upon European consuming centres as an outlet for its surplus production.

Recently, a further aspect of this question has revealed itself, namely, the effect of a substantial reduction in the American demand for coconut palm products. The decrease in the apparent consumption of coconut oil in the United States during the present depression has released appreciable supplies of Philippine produce for marketing elsewhere, particularly in Europe, since the American consumer can, of course, reduce his demand much

more rapidly than the Philippine producer can reduce his supply. As a result, exports of Philippine copra to France, for instance, increased from an average of about 7,000 tons in the period 1928 - 30 to 22,000 tons in 1931, and exports of Philippine coconut oil to the United Kingdom increased from an average of about 250 tons in the period 1928 - 30 to about 14,000 tons in 1931. This development shows that although the United States and the Philippines are largely interdependent as regards coconut palm products, maladjustment between supply and demand can have repercussions on the other producing and consuming areas, and that if American demand fails to keep pace with Philipine production—there were in 1931 over 200,000 acres of coconut palms in the Philippines not yet in full bearing—the European market may find itself subjected to a substantial increase in the offerings of Philippine copra and coconut oil, to the detriment, of course, of marketing possibilites of the produce of other coconut areas.

Demand in Europe.

Since 1924, there has been no evidence of any marked increase in the demand for coconut oil in the European countries taken as a whole. The apparent consumption in the United Kingdom, France, Germany, Denmark, Italy, Norway, the Netherlands and Czecho-Slovakia, which constitute the most important consuming centres of Europe, amounted to about 400,000 tons per annum in the period 1924 to 1927 and about 430,000 tons per annum in the period 1928 to 1931. The development of demand in Europe has been seriously hindered by the increase in supplies of ground nuts and other competing oilseeds, but particularly by the heavy production of whale oil which is largely absorbed in the European margarine and soap industries. Whale oil production increased from 130,000 tons in 1924 - 25 to 600,000 tons in 1930 - 31. The serious price fall in whale oil in recent years has resulted in drastic cuts in the whaling plans for 1932 - 33, the esitmated production for which is 300,000 to 400,000 tons, and if these plans materialise the European demand for coconut oil should appreciably benefit.

Future Supplies.

A longer view of the situation suggests that the supplies of coconut palm products should continue to expand as the areas under cultivation, which increased by about 30 per cent. between 1921 and 1930, come into full bearing. Moreover, the world exports of copra and coconut oil in 1930 and 1931 were much below the peak of 1929, thus indicating that supplies could in any case readily respond to an increase in demand. Future supplies are therefore assured, and the expansion of demand is undoubtedly the principal factor upon which the future prosperity of the industry depends. The demand for coconut oil, which, as has already been pointed out, is by far the most important form in which the coconut enters into final consumption, depends on the one hand

on the growth of the soap and of the margarine industries and on the other hand, on the competition of other vegetable oils and fats and animal and marine fats utilised in these industries.

Substitution of Coconut Oil by Other Oils.

The expansion of the soap and margarine industries should continue with the general increase in population and with a resumption of the rise in the standard of living. As regards the substitution of one oil or fat for another in these industries, the prospects are not so easy to define. Substitution is primarily dependent upon the special properties which the competing fats possess and with the widened uses for inferior oils brought about by improvements in technical processes. The large increase in the share of coconut oil in the oleo-margarine industry in the United States of America and its increased utilisation in the soap industry of the United Kingdom in recent years may be attributed to the special characteristics which it possesses and the special qualities which it gives to these commodities. But price considerations also play an important part in the choice of substitutable oils and fats, and over a relatively short period the price factor is probably the more potent. It remains to be seen whether the net results of the efforts being made to reduce the costs of competing vegetable oils and the probable rise in price of animal and marine fats resulting from the restriction in the world's livestock population and the whaling catch will be such as to permit of the more effective competition of coconut oil with substitutable oils and fats such as tallow, palm oil, palm kernel oil, groundnut oil, cottonseed oil and whale oil.

H. D. M.

UTILISATION OF PALM OIL IN THE U. S. A.

From the United States Tariff Commissioner's Report to the Congress on Certain Vegetable Oils, Whale Oil and Copra. Report No. 41, Second Series. 240 pp. Published by the United States Government Printing Office, Washington, March 23rd, 1932.

The above report comprises the results of investigations instituted by the U.S. Government into the cost of production and transportation of coconut oil, copra, palm and palm kernel oil, whale oil and other foreign oils, also a statement of their principle uses in the U.S.A. and of the kinds and amounts of domestic oils and fats replaced in domestic industry by such imports.

The imports of palm oil into the U.S.A. have risen from nearly 42 million lbs. in 1920 to 287 million lbs. in 1930. A further 39 million lbs. of palm kernel oil were imported in the same year. Palm oil is now chiefly imported in bulk from West Africa and Netherlands India. In 1930 the imports from the former country amounted to over 184 million lbs. and from the latter nearly 77 million lbs : a further 9 million lbs. being imported from the United Kingdom, acting as entrepôt for the product from Africa and other countries.

The industries which in the U.S.A. are the principle absorbers of palm oil are those of soap making, tin plating and margarine making, which in 1930 consumed approximately 192 million lbs., 15 million lbs., and 0.86 million lbs. respectively. The consumption of palm kernel oil in the soap making industry in 1930 was 29 million lbs : approximately 10 million lbs. of this oil was also used for edible purposes.

Replacement of Foreign by Domestic Oils.

The report states under the heading of aspects of the question of replacement of foreign by domestic oils that practically the whole of the 192 million lbs. of palm oil used in the soap industry may be taken as being technically interchangeable with domestic inedible tallow.

Coconut and palm oil, however, which form a large fraction of the now increasingly popular kinds of soap, such as hard toilet and most white laundry soaps which lather quickly and profusely even in cold hard water, cannot be greatly reduced or replaced by other animal or vegetable oils without making a material change in the character of these soaps.

For the use of palm oil in the manufacture of tin plate, for which as already stated, 15 million pounds are consumed annually, no satisfactory substitute has so far been developed on a commercial scale.

Increased Home Production of Oils.

The report states that a reduction of imports of vegetable oils would, to a considerable extent, be offset by an increase in domestic production of their substitutes or a decreased export of these substitutes.

The four principle sources of home produced oils which are used as food and soap oils are oleo-oil, cotton seed, corn and peanut.

It is not considered likely that increased demands for oleo-oil (a by-product of the beef industry) and tallow would be merely met by an increasing production of cattle, sheep and hogs since the price of meats, the major product, would be a more important consideration than that of oils. An increased demand for the latter might, however, result in such changes in methods of animal feeding as would result in a greater proportion of fat, but whether this would prove profitable or popular, is, the report states, uncertain, as such change would affect the character of the meat sold and not merely add to its oil content.

A further possible means of increasing the supply of animal fats lies in a reduction of their wastage which could undoubtedly be carried out if prices were high enough to justify the effort.

An increased production of whale oil is not anticipated as the supply of whales in the region to which American whalers at present confine their operations, appears to be approaching exhaustion.

Any increase in the production of cotton seed would involve a corresponding increase in that of cotton and thus affect the price of cotton.

Since corn oil is extracted from the germ of the corn grain and only a limited amount of corn is treated in such a way that the germ is removed, it is unlikely that any notable increase in this oil could be produced to meet an increased demand.

In the case of the peanut, which is grown in the U.S.A. chiefly for use as a food or for conversion into peanut butter, it is questionable whether it would be profitable to grow large quantities of this crop for the primary purpose of extracting the oil and its joint product, oil cake.

It would appear from the foregoing that although the tendency is for the U.S.A. to seek to reduce its imports of foreign oils by a correspondingly increased production of domestic oils, the problem is not a simple one, since all such oils are at present merely the by-products of other industries.

H. D. M.

Departmental.

FROM THE DISTRICTS.

The Weather.

Weather generally throughout the country was very dry, the recorded rainfall being below the average in most cases. Much of the west coast area especially the Malacca-Johore region was without rain for the first three weeks of the month. During the last week local showers were experienced over most of the country. The contrast between the rainfall of January and February is very noticeable on the East of the main range, for example, the January total for Pekan or Kuantan was approximately 20 inches, while the February total was less than 2 inches. This is considerably below the normal February precipitation for these Stations.

Remarks on Crops.

Rubber.—Prices paid for kampong rubber declined still further during the month, the range throughout all districts being from $4 to $8 per picul for smoked sheet. Unsmoked sheet was sold at $3 to $6.80, and scrap at $1 to $4 per picul.

The dry weather caused a general and heavy wintering of rubber during the month. Tapping was thus somewhat reduced. As padi harvests were also in progress in many districts the attention of the cultivators was turned to this and tapping in the neighbourhood of such areas was almost wholly suspended. In districts where little or no padi is grown and the cultivator is dependent solely on rubber, tapping was as heavy as usual.

The dry weather combined with reduced tapping activity caused a general decline of mouldy rot. As the new flush of leaves appeared during the last week of the month cases of Oidium were to be expected, but so far only two isolated cases have been reported from Johore.

Padi.—In most districts the harvesting of padi was largely completed during the month, and preliminary reports show that the crop obtained is generally well above the average, except where late planting is practised. In such areas the dry weather occurred too soon and the crops harvested will be below average. With the heavy new crop, prices of padi at the Bagan Serai Mill remained stationery at $1.62 per picul, the figure to which they dropped during last month. It is reported that Chinese millers in the Krian District are having difficulty in purchasing supplies of padi as they cannot offer better prices than the Government Mill.

It is noteworthy that an increase over last year's crop of about a million gantangs is reported from the Temerloh District. This should allow a large surplus for export from the District to other parts if the difficulty of cost of transport can be overcome. With regard to trials made in Selangor to produce

two crops of padi in one year it is satisfactory to record that at Rasa 580 gantangs per acre were obtained from two crops, one reaped in July, 1932, and one in February, 1933. This compares very favourably with a total yield of 150 gantangs from one crop in the 1931 - 32 season on the same land although the crop for that season was probably below normal from various causes. New import duties on padi and rice entering Kedah have come into force, an Empire preference of 10 cents per picul being allowed. Duty on foreign rice and padi is 25 cents per picul. An effort is being made in one mukim in Province Wellesley, in conjunction with the Co-operative Officer, to bulk the padi from a number of growers and sell direct to Penang in the expectation of the growers receiving a higher price than that offered by the local middlemen.

Coconuts.—The price of fresh nuts has generally declined slightly over the whole country, probably largely owing to a decrease in demand following Malay and Chinese holidays.

Progress in the improvement of small-holders' kilns and in the quality of copra manufactured continues. The Assistant Chemist for Copra Research visited Province Wellesley and reported very favourably on the kilns both at Tassek Chempadek and Sungei Acheh and the copra produced on them. In the Sabak Bernam District of Selangor, enthusiasm continues, a slight decline in the general price of copra being to some extent offset by the enhanced price of well-prepared copra. Several more copra groups with a common kiln have been formed in this District. At Temerloh a Malay built clay kiln has been completed and production of copra is expected to follow shortly, samples of which will be forwarded to headquarters for examination and report by the Assistant Chemist for Copra Research.

Tobacco.—A block of 30 acres is under tobacco cultivation at Lenggong (Perak) where local cheroots are being manufactured. Smaller blocks aggregating 18 acres are being planted up in the Baling and other Districts of Kedah.

Padi Experiment Stations and Test Plots.

Reports indicate that harvesting of padi is now well advanced or finished on the majority of Padi Plots and at the Padi Experiment Stations. Crops reaped have been generally satisfactory. In certain cases bird damage has caused fairly heavy losses, particularly at Kamunting (Perak) and Rembau.

The construction of the main drain for the Bachang Irrigation Scheme in Malacca has necessitated the removal of the pumping plant on the Pulau Gadong Padi Station. A larger and more efficient pump will be installed before the next planting season.

DEPARTMENTAL NOTES.

Tour of the Director of Agriculture.

Dr. H. A. Tempany, C.B.E., Director of Agriculture, S.S. and F.M.S. visited Kelantan from the 5th to 10th of February at the invitation of the Government of Kelantan, with the object of reporting on the conditions of the agricultural services in that State. During the tour he visited a number of parts of Kelantan in company with the Principal Agricultural Officer and discussed numerous problems. The Director's report of his visit has been submitted to the Kelantan Government.

Marketing of Peasant Produce.

The liaison committee between the Agricultural and Co-operative Departments and the Rubber Research Institute, referred to under this heading in the Departmental Notes of the previous month, has now been established. This committee comprises the membership of the Director of Co-operation, the Director of Agriculture, the Director, Rubber Research Institute, the Chief Agricultural Field Officer, the Agricultural Economist, the Assistant Director of Co-operation, North and the Assistant Director of Co-operation, South.

The establishment of this committee constitutes an important step forward in relation to the organisation of efforts to improve the conditions of the marketing of peasant produce.

Two meetings of this committee have already been held at which various questions such as District Economic Boards, village fairs, improvement in the marketing of poultry, programmes for the propaganda and lecture caravan and allied subjects were discussed. It appears likely that the functions of the Committee will lead to useful results in connection with this important problem.

Agricultural Advisory Committee.

A meeting of the Agricultural Advisory Committee was held at the head office of the Department of Agriculture, in Kuala Lumpur on February 16th whereat all members of the Committee were present with the exception of Mr. Choo Kia Peng, C.B.E and Mr. R. M. E. Michaux.

At the meeting various subjects were discussed, these included :—

Copra.—The Committee was informed that the Government of the Federated Malay States has accepted their recommendation that the services of the Assistant Chemist for Copra Investigations be continued.

It was stated that this officer is now engaged on the preparation of a bulletin on copra which will summaries the whole of his work up to date.

Tobacco.—The meeting was informed that a Committee with the Commissioner, Trades and Customs as Chairman, has reported to Government fiscal measures which should be adopted in view of the extension of tobacco cultiva-

tion in Malaya, having regard to the prevention of undue loss of revenue while encouraging the development of this industry.

The Chairman stated that he is sanguine that yellow tobacco of a type suitable to replace leaf now imported for the manufacture of lower grade cigarettes can be produced and cured in Malaya, but that it is necessary that definite proof of this should be obtained before propaganda for its cultivation can be started. The Committee was informed that locally grown cheroot tobacco has been proved to be of equal quality to that imported from Burma but that there is considerable difficulty in dealing with this trade since the local market could easily be overstocked.

It is estimated that the total area under tobacco in Malaya at the end of 1932 was 4,745 acres.

Mouldy Rot.—The Committee was informed that the Department of Agriculture has recommended to Government that the sale of disinfectants should be carried out by District Officers and Malay head men and that this recommendation is still under consideration by Government. The Committee was informed that the possibility of employing non-proprietory chemicals for the treatment of mouldy rot is under consideration by the Rubber Research Institute.

Poultry.—The Committee was informed that the Department of Agriculture has held intensive discussions with the Co-operative Department and with Government on the question of the encouragement of poultry raising, from which it has emerged that three useful avenues for work exist.

(1) The organisation of distribution of poultry and eggs. Schemes for the sale of eggs already exist, sponsored by the Co-operative Department.

(2) Provision of instruction for the small producer on better methods of handling poultry and

(3) Treatment and prevention of disease.

General.—The Committee unanimously concurred with the suggestion that there should be two Malay members of the Agricultural Advisory Committee instead of only one Malay member as hitherto.

Leave.

Mr. D. H. Grist, Agricultural Economist and Editor, S.S. and F.M.S. has been granted 10 months and 10 days leave on full pay with effect from 23rd February, 1933. Mr. A. Thompson, Acting Mycologist, has been appointed to act for Mr. Grist during his absence.

Notification of Oidium Heveae.

During the forthcoming wintering season and refoliation of the rubber trees of Malaya the Rubber Research Institute desires the co-operation and help of all estate managers in an endeavour to determine the extent and virulence of the disease known as Leaf Mildew or "Abnormal Leaf Fall" caused by the fungus *Oidium-Heveae*. Steinm.

The symptoms of the disease are briefly as follows:—

The fungus is most active during the refoliation period. The young leaves of the rubber tree become infected by spores which develop a creeping surface mycelium bearing upright sporulating structures. Patches of the sporulating fungus may be felt, or seen as a thin glistening film on the underside of the leaf when viewed obliquely.

The midrib of the young leaf is most favoured by the fungus and from the lowest point of infection to the tip, the leaf rapidly becomes shrivelled, dull, browned in patches, and blackened. It eventually falls off, the leaf stalk remaining attached to the tree. The flowers also may be attacked, fall off and thereby greatly reduce the seed harvest.

In this connection, the Institute would be grateful if managers who observe the young leaf to be falling from rubber trees on their estates, would pick from the tree a number of whorls of sickly leaves and flowers and forward them direct to the Institute for examination. Such specimens should be packed loosely in a tin or a cardboard box, it is not necessary to damp them unless they have to travel a long distance, in which case a piece of wet blotting paper should be placed at the bottom of the box.

As much information as possible should be given, such as rainfall for the past three months, age of trees affected, number of defoliations of individual trees observed, type of soil, drainage, whether manured or not and if yield is affected in any way differently from that usually experienced during wintering. Any other relevant information will be appreciated.

Statistical.

MARKET PRICES.

February, 1933.

Rubber.—The highest price recorded in Singapore during February for rubber smoked sheet, equal to London Standard was 6 6/16 cents per lb. on from the 3rd to 14th, and the lowest price 6.0 cents on 28th. The average price for the month was 6.25 cents per lb. in Singapore, 2.06d. London and 2.87 cents gold New York, as compared with 6.75 cents, 2.28d. and 30.1 cents gold respectively in January 1933.

Palm Oil.—The course of the English market during the month of February, on a basis of 18 per cent. f.f.a., c.i.f. Liverpool, was as follows; 2nd, £13.17.6 per ton; 9th, £15.10.0 nominal; 16th, £16.0.0 nominal; 23rd, £13.15.0. Prices in the U.S.A. landed weight c.i.f. New York/Philadelphia, were 2.15 cents gold per lb. on 8th, and 2.00 cents gold on 22nd of the month.

Palm kernels, Fair Average Malayan Quality, c.i.f. landed weight on the Continent realised 9 shillings per cwt. on the 22nd of February.

Copra.—The highest Singapore price for sundried during February was $4.95 per picul in the middle of the month, falling to $4.40 per picul at end of month, the average price being $4.74 per picul as compared with $5.16 in January. The mixed quality averaged $4.32 as compared with $4.72 in the previous month.

Copra cake averaged $2.05 per picul.

Coffee.—The prices at Singapore for Sourabaya coffee remained steady, averaging $25.40 to $27.50 per picul, the price within the range depending upon quality.

Palembang coffee averaged $20.40 per picul as compared with $19.75 in January.

Arecanuts.—Palembangs averaged $2.25 per picul and Bila Whole averaged $2.49 as compared with $2.75 and $2.69 per picul respectively in January. Singapore average prices for other grades were :—Split $3 to $5.09, Red Whole $4 to $4.75, Sliced $5.94 to $7.25 per picul, the price within each range depending on quality.

Rice.—The following are the average wholesale prices per picul of rice in Singapore during January :—Siam No. 2 $3.40, Rangoon No. 1 $3.24, as compared with $3.65 and $3.20 per picul during December. The average retail market prices in cents per gantang of No. 2 Siam rice in January were :—Singapore 25, Penang 29, Malacca 27, as compared with 28, 30 and 27 cents respectively in December.

Gambier.—Block Gambier has remained steady throughout the month at $5 per picul and Cube at $8 per picul. The average prices during January were Block $5 and Cube $8.75.

Pineapples.—Prices have remained practically unchanged, the average Singapore prices per case in February being :—Cubes $3.19, Sliced Flat $2.90, Sliced Tall $3.21, as compared with $3.20, $2.97 and $3.34 respectively during January.

Tapioca.—There has been a good demand and prices have been firm. Pearl seed appreciated by $1 per picul towards the end of the month, the average price per picul being $5.25 as compared with $4.60 during January.

The price of Flake averaged $4.84 as compared with $4.10 in January and Pearl medium averaged $5.44 as compared with $4.75 in the previous month.

Sago.—Pearl small fair remained at the same price as in the previous month, *viz.* $3.90. Flour Sarawak Fair averaged $1.94 as compared with $2.01 in January.

Mace.—Prices, more or less nominal, are quoted at $62 per picul for Siouw and $40 for Amboina.

Similar prices have ruled for the past three months.

Nutmegs.—The average Singapore prices per picul for 110's were $21.25 per picul and 80's $25.12 per picul. as compared with $25 and $26.50 per picul respectively during January.

Pepper.—Prices have shown a still further decline as compared with those of January. Singapore Black averaged $15.50 per picul, Singapore White $19.75 and Muntok White $20.06 during February, the corresponding prices for January being $16.62, $20.31 and $20.69 respectively.

Cloves.—There has been no demand for cloves, nominal prices being quoted at $40 for Zanzibar and $45 per picul for Amboina.

The above prices are based on London and Singapore daily quotations for rubber; the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil quotations are kindly supplied by Messrs. Cumberbatch & Co., Ltd. and Messrs. Guthrie & Co. Ltd., Kuala Lumpur, and the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore.

1 picul = 133⅓ lbs. The Dollar is fixed at 2s. 4d.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W. 1.

GENERAL RICE SUMMARY.*

January, 1933.

Malaya.—Gross foreign imports of rice (including stocks available for re-export) during January, 1933, amounted to 48,972 tons, as compared with 51,021 tons in January, 1932, of which 49 per cent. was consigned to Singapore, 24 per cent. to Penang, 7 per cent. to Malacca, 18 per cent. to the Federated Malay States and 2 per cent. to the Unfederated States.

Of these imports 64 per cent. were from Siam, 34 per cent. from Burma, 1 per cent. from Indo-China and 1 per cent. from other countries.

Total foreign exports of rice from Malaya in January, 1933, were 14,120 tons (including 177 tons local production) as compared with 16,684 tons in January 1932, a fall of 15 per cent.

Of these exports 83 per cent. was consigned to Netherlands India and 17 per cent. to other countries.

India and Burma.—Total foreign exports of rice during December, 1932, were 109,000 tons as compared with 100,000 tons in November, 1932, and 151,000 tons in December, 1931, an increase of 9 per cent. in respect of the previous month and a decrease of 28 per cent. in respect of the same period in the previous year.

Total exports during the period January to December, 1932, were 2,075,000 tons as compared with 2,092,000 tons for the corresponding period of 1931.

Exports of rice and bran from Burma during January 1933, amounted to 167,906 tons, as compared with 291,541 tons for the corresponding period of 1932, or a decrease of 42.4 per cent. The final forecast of the padi area in Burma for the season 1932 - 33 is estimated at 12,290,000 acres, an increase of 3 per cent. as compared with the actual acreage for 1931 - 32.

The yield of padi is estimated at 7,362,500 tons, an increase of 17 per cent. as compared with the actual figures for 1931 - 32. The surplus available for export is estimated to be 4,662,000 tons, an increase of 28 per cent. as compared with the actual surplus of 1931 - 32.

Japan.—The area under padi during 1932 was 7,981,000 acres yielding 8,470,000 tons as compared with 7,959,000 acres and 7,744,000 tons during 1931, an increase of 0.3 per cent. in area and 9.4 per cent. in yield.

The actual crop for the the year 1932 totalled 8,470,000 tons and the amount held over between the 1932 season 1,249,000 tons.

Total imports are estimated as follows:—Korean rice 982,000 tons, Formosan 421,000 tons and Foreign 140,000 tons.

The consumption of rice for 1933 is estimated to be 10,011,000 and the estimated exports, 84,000 tons.

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*Abridged from the Rice Summary for January, 1933, compiled by the Department of Statistics, S.S. and F.M.S.

Siam.—The exportable surplus available for export is now estimated at 1,570,000 tons of rice and rice products.

French Indo-China.—Entries of padi at the port of Cholon during January, 1933, amounted to 72,000 (metric) tons, a decrease of 11 per cent. as compared with the same period of 1932.

Exports of rice from Saigon in January 1933, totalled 74,000 tons, a decrease of 5 per cent. as compared with January 1932.

Owing to a severe drought during the period of transplanting, the production in the season 1932 - 33 is expected to be small. The surplus available for export from Saigon this year is estimated at 1,132,000 tons.

Ceylon.—Imports during the period January to December, 1932, totalled 441,952 tons, a decrease of 1 per cent. as compared with the same period of 1931.

Of these imports 19.5 per cent. were from British India, 69 per cent. from Burma, 4 per cent. from the Straits Settlements and 11.1 per cent. from other countries.

Europe and America.—Quantities of rice shipped from the East were :—

(*a*) To Europe for the period January 1st to January 26th, 1933, 80,971 tons, an increase of 116.5 per cent. as compared with the same period of 1932. Of these 1933 shipments 39 per cent. were from Burma, nil from Japan, 54 per cent. from Saigon, 6 per cent. from Siam and and 1 per cent. from Bengal, as compared with 75 per cent. from Burma, nil from Japan, 22 per cent. from Saigon, 3 per cent. from Siam and nil from Bengal in the same period of 1932.

(*b*) To the Levant, period January 1st to December 30th 1932, 49,192 tons, a fall of 27 per cent. as compared with the same period of 1931.

(*c*) To America and the West Indies for the period January 1st to December 7th, 1932, 126,277 tons, a decrease of 19 per cent. as compared with the same period of 1931.

Italy.—The area under rice during the season 1932 - 33 was 335,000 acres as compared with 359,000 acres in 1931 - 33, a decrease of 6.7 per cent.

Production in 1932 - 33 was 646,000 tons as compared with 652,000 tons in 1931 - 32, a decrease of 0.9 per cent.

United States of America.—The area under rice in 1932 - 33 was 869,000 acres yielding 791,000 tons, a decrease as compared to the figures for 1931 - 32 of 10.4 per cent. in area and 12.5 per cent. in yield.

ACREAGE UNDER OIL PALM IN MALAYA, WITH ANNUAL PLANTINGS TO END OF 1932.

State	1917 or earlier	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	Total	Reserve Land
Perak	—	—	—	—	—	—	—	200	—	503	1,441	2,797	4,375	7,863	183	10	17,372	7,248
Selangor	215	213	229	651	598	443	1,891	1,575	1,316	1,830	1,435	886	1,012	645	141	235	13,315	5,588
Negri Sembilan	—	—	—	—	—	—	—	—	—	504	—	—	100	170	166	233	1,173	2,578
Pahang	—	—	—	—	—	—	—	—	—	—	—	592	95	101	—	—	788	348
Total F.M.S.	215	213	229	651	598	443	1,891	1,775	1,316	2,837	2,876	4,275	5,582	8,779	490	478	32,648	15,762
Johore	—	—	—	—	—	—	—	—	1,043	1,271	2,612	1,509	2,293	10,300	5,375	3,374	27,777	33,002
Kelantan	—	—	—	—	—	—	—	—	—	—	—	—	—	—	600	—	600	650
Total U.M.S.	—	—	—	—	—	—	—	—	1,043	1,271	2,612	1,509	2,293	10,300	5,975	3,374	28,377	33,652
Total Malaya	215	213	229	651	598	443	1,891	1,775	2,359	4,108	5,488	5,784	7,875	19,079	6,465	3,852	61,025	49,414

ACREAGE OF TAPPABLE RUBBER OUT OF TAPPING ON ESTATES OF 100 ACRES AND OVER, MALAYA, AT THE END OF JANUARY, 1933.

State or Territory	Acreage of Tappable Rubber end 1931	Estates which have entirely ceased tapping		Estates which have partly ceased tapping		Total (3) + (5)	Percentage of (7) to (2)
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Federated Malay States :—							
Perak	250,951	13,248	5.3	31,705	12.6	44,953	17.9
Selangor	308,379	18,092	5.9	37,324	12.1	55,416	18.0
Negri Sembilan	228,541	18,804	8.2	21,973	9.6	40,777	17.8
Pahang	38,141	8,426	22.1	4,595	12.0	13,021	34.1
Total F.M.S. ...	826,012	58,570	7.1	95,597	11.6	154,167	18.7
Straits Settlements :—							
Province Wellesley	44,734	2,019	4.5	8,637	19.3	10,656	23.8
Dindings	6,969	310	4.4	1,128	16.2	1,438	20.6
Malacca	111,780	5,548	5.0	21,885	19.6	27,433	24.5
Penang Island	1,635	1,058	64.7	79	4.8	1,137	69.5
Singapore Island	28,269	12,770	45.2	3,936	13.9	16,706	59.1
Total S.S. ...	193,387	21,705	11.2	35,665	18.4	57,370	30.0
Unfederated Malay States :—							
Johore	(*d*) 313,385	42,769	13.6	33,293	10.6	76,062	24.3
Kedah (*a*) (*c*)	114,254	11,114	9.7	7,112	6.2	18,226	16.0
Kelantan	21,175	9,692	45.8	1,721	8.1	11,413	53.9
Trengganu (*b*)	4,352	Nil	Nil	2,072	47.6	2,072	47.6
Perlis (*c*)	957	106	11.1	502	52.5	608	63.5
Total U.M.S. ...	454,123	63,681	14.0	44,700	9.8	108,381	23.9
Total Malaya ...	1,473,522	143,956	9.8	175,962	11.9	319,918	21.7

Notes :— (*a*) Registered companies only and are rendered quarterly.
(*b*) Registered companies only.
(*c*) The figures quoted for Kedah and Perlis are those for September and December 1932, respectively, revised figures will be published when available.
(*d*) Figure for end December, 1932 is not yet available.

MALAYA RUBBER STATISTICS — TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF JANUARY, 1933 IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month		
	Ports	Dealers	Estates of 100 acres and over	during the month	January 1933	during the month	January 1933	during the month		January 1933		during the month		January 1933		Ports	Dealers	Estates of 100 acres and over
								Foreign	From Malay States Labuan	Foreign	From Malay States Labuan	Foreign	Local	Foreign	Local			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES :—																		
Federated Malay States	...	14,718	13,273	11,526	11,526	8,180	8,180	Nil	Nil	Nil	Nil	14,675	5,967	14,675	5,967	...	13,980	13,052
Johore	...	2,640	3,362	3,140	3,140	4,171	4,171	Nil	3	Nil	3	945	6,805	945	6,805	...	2,433	3,133
Kedah	...	835	2,540	2,631	2,631	1,298	1,298	Nil	Nil	Nil	Nil	1,095	2,883	1,095	2,883	...	730	2,596
Perlis	...	37	15	3	3	18	18	Nil	Nil	Nil	Nil	Nil	20	Nil	20	...	32	51
Kelantan ...	...	160	121	127	127	196	196	Nil	Nil	Nil	Nil	90	280	90	280	...	97	137
Trengganu ...	...	55	50	87	87	44	44	Nil	Nil	Nil	Nil	Nil	131	Nil	131	...	55	50
Total Malay States	...	18,445	19,361	17,514	17,514	13,907	13,907	Nil	3	Nil	3	16,805	16,086	16,805	16,086	...	17,327	18,989
STRAITS SETTLEMENTS :-																		
Malacca ...	...	5,697	1,512	1,369	1,369	2,199	2,199	9	16,121	9	16,121	3,932	Nil	3,932	Nil	...	6,494	1,513
Province Wellesley	...	145	593	595	595			Nil		Nil						...	1,057	704
Dindings ...	...	33	86	101	101			Nil		Nil		7,809		7,809		...	26	120
Penang	2,231	5,046	10	2	2			540		540						1,538	5,334	10
Singapore ...	3,827	19,823	215	135	135			5,608		5,608		18,053		18,053		4,473	16,824	181
Total Straits Settlements	6,058	30,744	2,416	2,202	2,202	2,199	2,199	6,157	16,121	6,157	16,121	29,794	Nil	29,794	Nil	6,011	29,735	2,528
TOTAL MALAYA	6,058	49,189	21,777	19,716	19,716	16,106	16,106	6,157	16,124	6,157	16,124	46,599	16,086	46,599	16,086	6,011	47,062	21,517

TABLE II
DEALERS' STOCKS, IN DRY TONS 7

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Total
20	21	22	23	24	25	26
DRY RUBBER	10,742	15,369	4,875	7,371	990	39,347
WET RUBBER	3,238	1,455	459	206	1,443	6,801
TOTAL ...	13,980	16,824	5,334	7,577	2,433	46,148

TABLE III
FOREIGN EXPORTS 4

PORTS	For month	January 1933
Singapore ...	27,140	27,140
Penang ...	11,516	11,516
Port Swettenham.	7,253	7,253
Malacca ...	690	690
MALAYA ...	46,599	46,599

TABLE IV
DOMESTIC EXPORTS 8

AREA	For month	January 1933
Malay States ...	39,623	39,623
Straits Settlements		
MALAYA ...	39,623	39,623

Notes:—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [19A] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of less than 100 acres, reduced by 15% to terms of dry rubber.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. Domestic exports are estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5 The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 21st of February 1933.

METEOROLOGICAL SUMMARY, MALAYA, JANUARY, 1933.

Locality	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes						Total		Most in a day	Number of days					Total	Daily Mean	Per cent
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet			Amt.	Precipitation .01 in or more	Precipitation, .05 in or more	Thunderstorm	Fog morning obs.	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hr.	hr.	%
Railway Hill, Kuala Lumpur, Selangor ...	88.9	71.8	80.3	92	69	76	74	83.3	84.0	6.10	154.9	1.46	18	14	3	11		182.35	5.88	
Bukit Jeram, Selangor ...	86.9	72.1	79.5	89	70	77	74	82.8	85.1	11.98	304.3	2.04	21	17	11	3		201.30	6.49	
Sitiawan, Perak ...	88.6	72.7	80.7	92	69	85	75	83.3	84.0	8.30	210.8	1.49	21	18	4	3		184.60	5.95	
Kroh, Perak ...	84.0	68.7	76.3	87	64	77	71	79.0	80.5	3.52	89.4	1.55	19	11				204.35	6.59	
Temerloh, Pahang ...	84.1	71.9	78.0	89	66	75	74	82.4	84.1	10.22	259.6	2.50	23	21				117.75	3.80	
Kuala Lipis, Pahang ...	84.1	70.9	77.5	88	66	78	73	81.0	82.5	10.55	268.0	1.26	28	27	1	17		106.60	3.44	
Kuala Pahang, Pahang ...	82.5	75.2	78.9	85	72	81	78	80.4	82.7	12.48	317.0	3.74	27	22				143.75	4.64	
Mount Faber, Singapore ...	85.2	72.5	78.9	90	71	76	74	79.9	81.7	11.02	279.9	2.29	22	18	1			146.10	4.71	39
Butterworth, Province Wellesley ...	87.9	73.1	80.5	91	71	82	76	83.8	84.6	4.23	107.5	1.18	13	11				223.45	72.1	
Bukit China, Malacca ...	85.3	73.0	79.1	88	70	80	75	80.2	82.2	6.46	164.1	4.98	13	11				159.40	5.14	43
Kluang, Johore ...	83.3	72.2	77.7	88	69	75	74	79.2	80.9	13.61	345.7	2.32	22	20	1	3		121.80	3.93	33
Bukit Lalang, Mersing, Johore	81.1	74.0	77.5	84	71	78	76	78.9	79.7	12.01	305.1	2.02	24	20				123.75	3.99	33
Alor Star, Kedah ...	88.6	71.3	79.9	91	68	82	74	82.0	84.0	2.65	67.3	1.52	8	5	1			239.40	7.72	65
Kota Bahru, Kelantan ...	83.2	73.5	78.3	85	70	81	76	80.4	82.2	6.12	155.5	1.02	26	17				167.25	5.39	
Kuala Trengganu, Trengganu	82.2	73.6	77.9	84	70	79	77	79.4	80.8	5.22	132.6	1.20	25	21		2		150.40	4.85	11.9
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft. Pahang ...	67.0	60.4	63.7	71	58	63	62	69.1	70.0	18.35	466.1	2.43	27	26	1	26		57.05	1.84	
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	69.4	59.7	64.5	73	55	65	62	68.1	68.6	6.04	153.4	1.63	23	19				140.00	3.35	
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	68.1	58.3	63.2	73	55	63	60			6.28	159.5	1.67	25	20		5		111.30	3.59	

Compiled from Returns supplied by the Meteorological Branch, Malaya.